

GATE ENTRY SYSTEM USING SHORT RANGE RADIO COMMUNICATIONS WITH USER TERMINAL DEVICES

5 BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a gate entry system for regulating passages of passengers.

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DESCRIPTION OF THE RELATED ART

As a conventional gate entry system for regulating passages of passengers, there is an automatic checking and collecting machine used at a railway station, for example.

15 In order to pass the automatic checking and collecting machine, the user enters a commutation pass of the user into the automatic checking and collecting machine, and if the commutation pass is recognized as valid, the user can pass the automatic checking and collecting machine. For
20 this reason, by the use of the automatic checking and collecting machine, it has been possible to comprehend users of the station accurately, while limiting passages of users quickly.

However, in the conventional automatic checking and
25 collecting machine, a ticket or pass conveyor section and a ticket or pass examination section have been expensive so that the price of the automatic checking and collecting machine itself has been very high. Also, the conveyor section requires the fine-tuning and the maintenance cost
30 due to its severe operating environment. In addition, when the area for placing the automatic checking and collecting machine is limited, the automatic checking and collecting machine itself is so large that there has been a drawback that it is difficult to place many automatic checking and
35 collecting machines. Also, there has been an inconvenience

that tickets usable for the automatic checking and collecting machine can be purchased only at limited places such as the railway station.

As a technique for overcoming such drawbacks, there is
5 a contactless radio IC card (ISO14443). The contactless
radio IC card is formed by a short range radio
communication unit of the electromagnetic induction type, a
tamper-resistant memory, and a process unit MPU, and the
automatic checking and collecting machine can detect and
10 check the card in a short period of several hundred msec.,
when the card is brought within a distance of approximately
10 cm from a reader/writer implemented in the automatic
checking and collecting machine. The user can pass the
automatic checking and collecting machine by simply holding
15 the commutation pass card close to the reader/writer, so
that there is no need for the conveyor section.

On the other hand, the radio technology for use in the
portable telephone and the like has been developed
recently, and in particular the short range radio
20 technology called Bluetooth is currently attracting much
attentions. The Bluetooth is designed for the consumer use
and the mobile use so that it has features of a low power
consumption and a low cost, and it is expected to be
installed on many portable devices in near future. The
25 Bluetooth can cooperate not only with the personally owned
devices but also with any peripheral electronic devices, so
that it has a potential for providing the powerful network
infrastructure for realizing various services.

Compared with the contactless radio IC card, the
30 Bluetooth has drawbacks in its long processing time and its
weak security. However, if it is possible to develop an
automatic checking and collecting machine in which the user
can pass by utilizing a portable telephone with the
Bluetooth installed thereon, there can be an advantage in
35 that it becomes possible for the user to pass the automatic

checking and collecting machine by utilizing his own portable telephone without being required to purchase a ticket or the like. Also, by utilizing the Bluetooth for the other purposes, it can be expected that a highly attractive commercial market will be created.

However, in the case of applying the Bluetooth to the automatic checking and collecting machine, there is a possibility for erroneously establishing the communication connection with the Bluetooth of the terminal device owned by a person other than the passenger who is currently trying to pass the automatic checking and collecting machine (such as a subsequent passenger, for example) and checking that other person's ticket rather than the passenger's ticket.

Also, when a plurality of passengers enter into the automatic checking and collecting machine consecutively, the communication data of the plurality of passengers will come into the radio wave reachable range of the Bluetooth on the automatic checking and collecting machine, such that it becomes impossible for the automatic checking and collecting machine side to check tickets in the correct order by which the passengers entered the automatic checking and collecting machine.

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BRIEF SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a gate entry system capable of carrying out the processing of the passengers properly at the automatic checking and collecting machine side, even when the Bluetooth is applied to the automatic checking and collecting machine, for example.

According to one aspect of the present invention there is provided a gate entry system for regulating passages of

passengers, comprising: a wall unit configured to form a passageway that is extended along a passing direction of the passengers; a gate unit provided at an exit side of the passageway, which is capable of being opened or closed to regulate the passages of the passengers; human sensors configured to sense the passengers in the passageway; a radio communication unit configured to detect a number of passengers entering into the passageway according to outputs of the human sensors, and carry out transmission/reception of data with respect to at least one terminal device of one passenger; and a control unit configured to control opening or closing of the gate unit according to the data received by the radio communication unit.

Other features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing a perspective view of a gate entry system according to one embodiment of the present invention.

Fig. 2 is a diagram showing a plan view of a ticket gate device of the gate entry system according to one embodiment of the present invention.

Fig. 3A is a block diagram showing an internal configuration of a ticket gate device of the gate entry system according to one embodiment of the present invention.

Fig. 3B is a block diagram showing an internal configuration of a terminal device of the gate entry system according to one embodiment of the present invention.

Fig. 4 is a flow chart for an operation of the gate

entry system according to one embodiment of the present invention.

Fig. 5 is a flow chart for an invalidation processing to be carried out by a ticket gate device according to one embodiment of the present invention.

Fig. 6 is a flow chart for an operation of the gate entry system according to one embodiment of the present invention when more than one passengers have entered into a ticket gate device.

Fig. 7 is a flow chart for an operation of the gate entry system according to one embodiment of the present invention when a passenger tries to pass a ticket gate device despite of the fact that a data processing of the passenger at the ticket gate device is not completed.

Figs. 8A to 8D are diagrams showing perspective views of a ticket gate device of the gate entry system according to first to fourth modified embodiments of the present invention.

Fig. 9 is a block diagram showing an internal configuration of a ticket gate device of the gate entry system according to a fifth modified embodiment of the present invention.

Fig. 10 is a flow chart for an operation of the gate entry system according to a fifth modified embodiment of the present invention when a proper passenger does not pass a ticket gate device.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Fig. 1 to Fig. 10, one embodiment of a gate entry system according to the present invention will be described in detail.

(Configuration of the gate entry system)

Fig. 1 shows a schematic configuration of the gate

entry system according to this embodiment.

As shown in Fig. 1, the gate entry system of this embodiment has a ticket gate device 1 for regulating a passage of a passenger 30, and a terminal device 10 carried by the passenger 30. The ticket gate device 1 comprises: a wall unit 2 that is extended in a passing direction of the passenger and forming a passageway; a gate unit 3 provided at an exit side of the passageway which can be opened or closed for regulating the passage of the passenger; human sensors 4a to 4c for sensing the passenger in the passageway; a radio communication unit 5 for carrying out data transmission/reception with respect to the terminal device 10 carried by the passenger in the passageway by cooperating with the human sensors 4a to 4c; and display units 6a and 6b for displaying a state of progress of the processing by a control unit (not shown) to be described below.

Also, Fig. 2 shows a plan view of the ticket gate device 1 of Fig. 1 seen from the above. In Fig. 2, the shaded ellipses A2 to A4 indicate detectable ranges of the human sensors 4a to 4c. Also, an ellipse A1 shown between two portions of the wall unit 1 indicates a communication possible range of the radio communication unit 5. In this embodiment, as shown in Fig. 2, the detectable range A2 of the human sensor 4a is arranged at a front side of the communication possible range A1 of the radio communication unit 5 along the passing direction of the passageway.

In this embodiment, the wall unit 2 forms the passageway extended along the passing direction of the passenger 30, and constitutes the automatic checking and collecting machine body to be placed in the railway station, for example.

Also, as shown in Fig. 3A, the ticket gate device 1 has an internal configuration that includes the control unit 7.

The human sensors 4a to 4c for sensing the passenger in the passageway can be provided in forms of light sensors, weight sensors, etc., for example. Note that the human sensor 4a is arranged in a vicinity of an entrance of the ticket gate device 1, the human sensor 4b is arranged in a vicinity of a middle of the ticket gate device 1, and the human sensor 4c is arranged in a vicinity of an exit of the ticket gate device 1. The sensor signals of these human sensors 4a to 4c are outputted to a detection unit 7a inside the control unit 7.

The control unit 7 controls the gate unit 3 to open or close according to the received data. In this embodiment, the control unit 7 has the detection unit 7a and a judgement unit 7b, as well as an internal memory (not shown) for storing the control program, etc.

The detection unit 7a judges whether the human sensors 4a to 4c have sensed the passenger 30 or not. More specifically, when the sensor signal from the human sensor 4a is entered, the detection unit 7a outputs a reception signal for receiving data from the terminal device 10 to the radio communication unit 5. Also, when the sensor signal from the human sensor 4a and the human sensor 4b are entered, the detection unit 7a judges that more than one passengers 30 have entered into the ticket gate device 1, and outputs a subsequent entry refusal command signal for refusing an entry of the subsequent passenger 30 to the display unit 6a (6b).

The judgement unit 7b judges the validity of the data received by the radio communication unit 5. More specifically, when the data signal is received by the radio communication unit 5, the judgement unit 7b judges whether that data is valid or not in terms of a valid period, a valid region, etc., of the information data.

Then, when the detection signal indicating the detection of the sensor signal of the human sensor 4c fixed

to near the exit is transmitted from the detection unit 7a and it is judged that the data of the passenger is valid, the judgement unit 7b outputs a passing signal for passing the passenger 30 to the gate unit 3. On the other hand,

5 when it is judged that the data of the passenger is invalid, regardless of the sensor signal from the human sensor 4c, the judgement unit 7b outputs a passing refusal signal for blocking the passenger 30 to the gate unit 3.

Also, the control unit 7 can close the gate unit 3
10 when at least one of the human sensors 4b and 4c having the detectable ranges A3 and A4 that overlaps with the communication possible range A1 of the radio communication unit 5 detects the passenger before the data transmission/reception is completed.

15 The gate unit 3 is provided at the exit side of the passageway and opened or closed to control the passage of the passenger, using a servo controller driven by a servo motor, for example. More specifically, the gate unit 3 opens the gate so as to pass the passenger 30 when the
20 passing signal for passing the passenger 30 in the ticket gate device 1 is entered from the judgement unit 7b.

On the other hand, the gate unit 3 closes the gate so as not to pass the passenger 30 when the passing refusal signal for blocking the passage of the passenger 30 in the
25 ticket gate device 1 is entered from the judgement unit 7b.

The display unit 6a (6b) displays a state of the process by the control unit 7, and can be provided in a form of a LED display, a liquid crystal display, etc., for example. More specifically, the display unit 6a (6b) can
30 change the screen display content according to the signals entered from the detection unit 7a and the judgement unit 7b.

For example, when the detection unit 7a judges that more than one persons have entered into the ticket gate
35 device 1, the subsequent entry refusal command signal for

blocking the subsequent passenger 30 in the ticket gate device 1 is outputted to the display unit 6a (6b). When the subsequent entry refusal command signal is entered, the display unit 6a (6b) displays a message for blocking the entry of the subsequent passenger (such as "do not enter" or "passing disapproved", for example).

Namely, when the judgement unit 7b judged that the data is valid, the judgement unit 7b outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the display unit 6b. On the other hand, when the judgement unit 7b judges that the data is invalid, the judgement unit 7b outputs the passing refusal signal for not passing the passenger 30 in the ticket gate device 1 to the display unit 6b.

When the passing signal is transmitted from the judgement unit 7b, the display unit 6b displays a message indicating the validness (such as "valid"), whereas when the passing refusal signal is transmitted from the judgement unit 7b, the display unit 6b displays a message indicating the invalidness (such as "invalid", for example).

Also, when the processing of the data is still in progress, the judgement unit 7b outputs a processing in progress signal indicating that the processing is still in progress (a signal commanding the display of "processing", for example) to the display unit 6a (6b). When the processing in progress signal is transmitted from the judgement unit 7b, the display unit 6a displays a message for refusing the entry of the subsequent passenger 30 (such as "no further entry permitted", for example). Also, the display unit 6b displays a message indicating that the processing is in progress (such as "processing", for example). The display unit 6a (6b) can also display the state of progress of the processing by utilizing an indicator or the like.

Also, the display unit 6a (6b) has an entry regulation function for permitting an entry into the communication possible range A1 of the radio communication unit 5 to only one subsequent passenger while in the state where the connection with the terminal device 10 of one passenger is already established.

The radio communication unit 5 carries out the data transmission/reception to/from the terminal device 10 carried by the passenger 30 in the passageway, in cooperation with the human sensor 4a, and can be provided in a form of IrDA, Bluetooth, etc., for example. In particular, in this embodiment, the radio communication unit 5 carries out the establishing of the connection (communication connection) for the data transmission/reception to/from at least one terminal device 10 carried by one passenger, by detecting the number of the passengers entering into the passageway according to the outputs of the human sensors 4a to 4c.

Here, the data transmitted/received by the radio communication unit 5 may include a commutation pass for the train, a movie ticket, an identifier code specific to the terminal device, etc. Note that IrDA carries out the data communications with infrared rays, and the Bluetooth carries out the data communications with 2.4 GHz radio frequency.

Next, the terminal device 10 in this embodiment will be described.

Fig. 3B shows an internal configuration of the terminal device 10 in this embodiment. As shown in Fig. 3B, the terminal device 10 of this embodiment has a radio communication unit 12, a display unit 13 and a control unit 15 which are similar to the radio communication unit 5, the display unit 6a (6b) and the control unit 7 of the ticket gate device 1 described above, as well as an operation unit 11 and a memory unit 14 that are not existing in the ticket

gate device 1. In the following, the difference from the ticket gate device 1 will be mainly described.

The terminal device 10 is a portable device for transmitting data to the ticket gate device 1 through the radio communication unit 12, and can be provided in a form of portable telephone, PDA, etc.

The operation unit 14 enables the input of the information data and the operation of the screen display on the display unit 13, and can be provided in a form of keys on the portable telephone, for example. Note that the operation unit 14 can be a button shaped type, a joystick shaped type, or a speech input type. It is also possible to change the information displayed on a screen by using a touch panel provided on the screen of the display unit 13.

The memory unit 14 stores data of the passengers, and can be provided in a form of FFEROM, for example. It should preferably be a tamper-resistant memory in order to prevent the illegal alteration and the copying. It can possibly be provided in a form of a SD memory card for recording music, or SIM or UIM mounted on the portable telephone such as that of GSM or IMT2000. The data of the passengers to be stored here may include a ticket for the train, a ticket for the movie, an identification code specific to the terminal device, etc.

(Operations of the gate entry system)

The operation of the gate entry system in the above described configuration can be realized by the following procedure in this embodiment. Note that the following description is directed to the case of using the Bluetooth as the radio communication unit 5 or the radio communication unit 12.

(1) The operation in the case where the passenger passes the ticket gate device 1:

Fig. 4 shows a procedure for the operation up to the point where the passenger 30 passes the ticket gate device

1. As shown in Fig. 4, a step for turning the human sensor 4a ON is carried out first (step S101). More specifically, when the passenger 30 passes the human sensor 4a near the entrance of the ticket gate device 1, the human sensor 4a is turned ON. Then, when the human sensor 4a is turned ON, the detection signal indicating that the human sensor 4a is turned ON is outputted to the detection unit 7a of the control unit 7.

Then, a step for setting the radio communication unit 5 of the ticket gate device 1 in the connection ready state is carried out (step S102). More specifically, when the detection signal indicating that the human sensor 4a is turned ON is received, the detection unit 7a outputs the reception signal for receiving the data from the terminal device 10 to the radio communication unit 5. Then, when the reception signal is transmitted from the detection unit 7a, the radio communication unit 5 transmits a connection signal for carrying out the data exchange to the terminal device 10. Here, a message indicating the start of the ticket checking processing is outputted to the display unit 6b (which displays "processing" or an indicator for a prescribed time).

Next, the terminal device 10 receives the connection signal from the ticket gate device 1 (step S103), and a step for establishing the communication connection between the ticket gate device 1 and the terminal device 10 is carried out (step S106). On the other hand, when the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the communication connection is not established between the ticket gate device 1 and the terminal device 10 (steps S104 and S105).

More specifically, if the time-up function (not shown) in the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed

waiting period, the connection with the ticket gate device 1 is automatically interrupted. On the other hand, when the terminal device 10 received the connection signal within the prescribed waiting period, the connection is
5 established.

Next, a step for judging whether the data is valid or not is carried out (step S107). More specifically, after the communication connection is established between the ticket gate device 1 and the terminal device 10, the radio
10 communication unit 5 of the ticket gate device 1 receives the data from the terminal device 10, and outputs that data to the judgement unit 7b in the control unit 7. When that data is received, the judgement unit 7b judges the validity of the data, such as the date of the ticket, the names of
15 the stations to get on and off, the valid period of the ticket, etc.

Next, a step for displaying "valid" at the display unit 6b is carried out (step S108). More specifically, when it is judged that the data is valid as a result of judging
20 the validity of the data at the judgement unit 7b, the judgement unit 7b outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the display unit 6b. Then, when the passing signal is entered from the judgement unit 7b, the display unit 6b displays a message
25 indicating the validness such as "valid", for example.

Also, when the processing of the data is still in progress, the judgement unit 7b outputs the processing in progress signal indicating that the processing is still in progress to the display unit 6a (6b). Then, when the
30 processing in progress signal is transmitted from the judgement unit 7b, the display unit 6a (6b) displays a message for refusing the entry of the subsequent passenger 30 (such as "no further entry permitted", for example). Also, the display unit 6b displays a message indicating
35 that the processing is still in progress (such as

"processing", for example).

On the other hand, when it is judged that the data is invalid by judging the validity of the data at the judgement unit 7b, a step for carrying out the invalidation processing described below is carried out (step S110).

Then, a step for disconnecting the connection between the terminal device 10 and the ticket gate device 1 is carried out (step S109). More specifically, the detection unit 7a judges whether all of the human sensors 4a to 4c in the ticket gate device 1 are ON or not. When all of the human sensors 4a to 4c are OFF, the detection unit 7a judges that the passenger 30 has passed the ticket gate device 1, and outputs a disconnection signal for disconnecting the communication connection with the terminal device 10 to the radio communication unit 5. Then, when the disconnection signal is transmitted from the detection unit 7a, the radio communication unit 5 disconnects the communication connection with the terminal device 10.

Finally, a step for changing the displayed content of the display unit 6a (6b) to "passing permitted" is carried out.

Note that, in this embodiment, a step for displaying a message indicating that the data from the terminal device 10 is invalid such as "invalid", for example at the display unit 6b is carried out (step S201) at the invalidation processing step (S110) described above as shown in Fig. 5. More specifically, when it is judged that the data is invalid at the judgement unit 7b, the passing refusal signal for not passing the passenger 30 in the ticket gate device 1 is outputted from the judgement unit 7b to the display unit 6b. Then, when the passing refusal signal is entered from the judgement unit 7b, the display unit 6b displays a message indicating that the data from the terminal device 10 is invalid (such as "invalid", for

example).

Next, a step for closing the gate at the gate unit 3 is carried out (step S202). More specifically, when the passing refusal signal is entered from the judgement unit 7b, the gate unit 3 closes the gate by using a servo motor (not shown) in the gate unit 3. Thereafter, a step for displaying "do not enter" at the display unit 6a and "passing disapproved" at the display unit 6b is carried out (step S203). More specifically, when the passing refusal signal is entered from the judgement unit 7b, the display unit 6a displays a message for not passing the subsequent passenger (such as "do not enter", for example) and the display unit 6b displays a message for not passing the passenger 30 in the ticket gate device 1 (such as "passing disapproved", for example).

Then, a step for judging whether the passenger 30 exists in the ticket gate device 1 or not is carried out at the judgement unit 7b (step S204). More specifically, when the detection signals indicating that all of the human sensors 4a to 4c in the ticket gate device 1 become OFF are outputted from the detection unit 7a to the judgement unit 7b, the judgement unit 7b judges that no passenger exists in the ticket gate device 1.

Then, the judgement unit 7b outputs the disconnection signal for disconnecting the communication connection with the terminal device 10 to the radio communication unit 5. When the disconnection signal is received, the radio communication unit 5 disconnects the communication connection with the terminal device 10 (step S205). In this way, if the data is invalid as a result of judging the validity of the data at the judgement unit 7b, it is possible to block the passage of the passenger 30 in the ticket gate device 1.

On the other hand, when any one of the human sensors 4a to 4c in the ticket gate device 1 becomes ON and the

detection signal indicating turning ON of that human sensor is transmitted to the judgement unit 7b, the judgement unit 7b judges that the passenger 30 exists in the ticket gate device 1. Then, the judgement unit 7b which judges that the passenger 30 exists in the ticket gate device 1 commands the display unit 6b to continue to display a message for not passing the passenger 30 in the ticket gate device 1 (such as "passing disapproved", for example).

Finally, a step for switching the display of the display unit 6a (6b) is carried out (step S206). More specifically, when the disconnect signal is transmitted from the judgement unit 7b, the display unit 6a (6b) switches a message "passing disapproved" displayed on the display unit 6a and a message "do not enter" displayed on the display unit 6b to a message indicating the permission of the passing by the passenger (such as "passing permitted", for example).

(2) The operation in the case where two or more passengers 30 exist in the ticket gate device 1:

When two or more passengers 30 have entered into the ticket gate device 1, there can be cases where the data of the subsequently entered passengers 30 following the passenger 30 who entered into the ticket gate device 1 first is received and processed. For this reason, the following procedure is designed to carry out the data processing appropriately even when two or more passengers 30 have entered into the ticket gate device 1. Fig. 6 shows the processing procedure of this operation.

As shown in Fig. 6, a step for turning the human sensor 4a ON as the passenger 30 enters into the ticket gate device 1 is carried out first (step S301), and then a step for making the radio communication unit 5 in the ticket gate device 1 in the connection ready state is carried out (step S302). More specifically, when the passenger 30 passes the human sensor 4a near the entrance

of the ticket gate device 1, the human sensor 4a is turned ON. Then, the human sensor 4a is turned ON and the detection signal indicating turning ON of that human sensor is outputted to the detection unit 7a of the control unit

5 7.

Then, when the detection signal indicating that the human sensor 4a is turned ON entered, the detection unit 7a outputs the reception signal for receiving the data from the terminal device 10 to the radio communication unit 5.

10 Then, when the reception signal is received from the detection unit 7a, the radio communication unit 5 transmits a connection signal for carrying out the data exchange with the terminal device 10 (connection ready). Here, a message indicating the start of the ticket checking processing is
15 outputted to the display unit 6b (which displays "processing" or an indicator for a prescribed time).

Next, the terminal device 10 receives the connection signal from the ticket gate device 1 (step S303), and a step for establishing the communication connection between
20 the ticket gate device 1 and the terminal device 10 is carried out (step S306). When this communication connection with the terminal device 10 is established, the radio communication unit 5 of the ticket gate device 1 receives the data from the terminal device 10.

25 On the other hand, when the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the communication connection is not established between the ticket gate device 1 and the terminal device 10 (steps S304
30 and S305).

More specifically, if the time-up function (not shown) in the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the connection with the ticket gate device
35 1 is automatically interrupted. On the other hand, when the

terminal device 10 received the connection signal within the prescribed waiting period, the connection is established.

Next, a step for judging whether two or more persons
5 have entered into the ticket gate device 1 (checking and collecting machine, for example) or not is carried out by the detection unit 7a (step S307). More specifically, when all of the human sensors 4a and 4b are turned ON, an ON
10 signal indicating that both of the human sensors 4a and 4b are turned ON is outputted to the detection unit 7a. Then, when the ON signal is entered, the detection unit 7a judges that two or more passengers 30 have entered because both of the human sensors 4a and 4b are turned ON.

Next, a step for displaying "no further entry
15 permitted" at the display unit 6a (6b) is carried out. More specifically, when the ON signal indicating that both of the human sensors 4a and 4b are turned ON is entered, the detection unit 7a outputs the subsequent entry refusal
20 command signal for blocking the entry of the subsequent passenger 30 into the ticket gate device 1 (making the state of having only one passenger 30 in the ticket gate device 1) to the display unit 6a (6b). Then, when the
subsequent entry refusal command signal is received, the display unit 6a (6b) displays a message for refusing the
25 entry of the subsequent passenger 30 (such as "no further entry permitted", for example).

Next, a step for judging whether there is only one
passenger 30 in the ticket gate device 1 or not is carried out at the detection unit 7a (step S309). Then, when there
30 is only one passenger 30 in the ticket gate device 1, a step for releasing "no further entry permitted" displayed at the display unit 6a (6b) is carried out (step S310). On the other hand, when there are more than one passengers 30 in the ticket gate device 1, the display of "no further
35 entry permitted" at the display unit 6a (6b) is maintained.

More specifically, when it is detected that any one of the human sensors 4a and 4b is turned ON, the detection unit 7a judges that there is only one passenger 30 in the ticket gate device 1, and outputs a subsequent entry

5 refusal release command signal for releasing the display for refusing the entry of the passenger 30 to the display unit 6a (6b). Then, when the subsequent entry refusal release command signal is entered, the display unit 6a (6b) releases the display for refusing the subsequent entry.

10 Then, a step for judging whether the data is valid or not is carried out (step S311). More specifically, after the communication connection is established between the ticket gate device 1 and the terminal device 10, the radio communication unit 5 of the ticket gate device 1 receives
15 the data from the terminal device 10, and outputs that data to the judgement unit 7b. When that data is entered, the judgement unit 7b judges the validity of the data, such as the date of the ticket, the names of the stations to get on and off, the valid period of the ticket, etc.

20 Next, a step for displaying "valid" at the display unit 6b is carried out (step S312). More specifically, when it is judged that the data is valid as a result of judging the validity of the data at the judgement unit 7b, the judgement unit 7b outputs the passing signal for passing
25 the passenger 30 in the ticket gate device 1 to the display unit 6b. Then, when the passing signal is received from the judgement unit 7b, the display unit 6b displays a message indicating the validness such as "valid", for example.

Also, when the processing of the data is still in
30 progress, the judgement unit 7b outputs the processing in progress signal indicating that the processing is still in progress to the display unit 6a (6b). Then, when the processing in progress signal is received from the judgement unit 7b, the display unit 6a (6b) displays a
35 message for refusing the entry of the subsequent passenger

30 (such as "no further entry permitted", for example). Also, the display unit 6b displays a message indicating that the processing is still in progress (such as "processing", for example).

5 On the other hand, when it is judged that the data is invalid as a result of judging the validity of the data at the judgement unit 7b, a step for carrying out the invalidation processing is carried out (step S314). This step S314 for carrying out the invalidation processing is
10 similar to the invalidation processing shown in Fig. 5.

 Finally, a step for disconnecting the connection between the terminal device 10 and the ticket gate device 1 is carried out (step S313). More specifically, the detection unit 7a judges whether all of the human sensor 4a
15 to 4c in the ticket gate device 1 are ON or not. When the detection signal indicating that all of the human sensors 4a to 4c are OFF is received, the detection unit 7a judges that the passenger 30 has passed the ticket gate device 1, and outputs a disconnection signal for disconnecting the
20 communication connection with the terminal device 10 to the radio communication unit 5. Then, when the disconnection signal is transmitted from the detection unit 7a, the radio communication unit 5 disconnects the communication connection with the terminal device 10.

25 In this way, when more than one passengers 30 have entered into the ticket gate device 1, it is possible to give a warning for eliminating the subsequent passengers 30 so that it becomes possible to eliminate the subsequent passengers 30 quickly and it becomes possible to process
30 the ticket information in the order starting from the passenger 30 who entered first.

(3) The operation in the case where the passenger tries to pass the ticket gate device 1 quickly:

 There can be cases where the passenger tries to pass
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(3) The operation in the case where the passenger tries to pass the ticket gate device 1 quickly:

There can be cases where the passenger tries to pass the ticket gate device 1 despite of the fact that the
5 processing of the data carried out by the ticket gate device 1 is unfinished. If the passenger 30 tries to pass the ticket gate device 1 despite of the fact that the data of the passenger 30 is unprocessed, the following operation is carried out. Fig. 7 shows the processing procedure of
10 this operation.

As shown in Fig. 7, a step for turning the human sensor 4a ON as the passenger 30 enters into the ticket gate device 1 is carried out (step S401), and then a step for making the radio communication unit 5 in the ticket
15 gate device 1 in the connection ready state is carried out (step S402). More specifically, when the passenger 30 passes the human sensor 4a near the entrance of the ticket gate device 1, the human sensor 4a is turned ON. Then, when the human sensor 4a is turned ON, the detection signal
20 indicating turning ON of that human sensor is outputted to the detection unit 7a of the control unit 7.

Then, when the detection signal indicating that the human sensor 4a is turned ON is received, the detection unit 7a outputs the reception signal for receiving the data from
25 the terminal device 10 to the radio communication unit 5. Then, when the reception signal is transmitted from the detection unit 7a, the radio communication unit 5 transmits a connection signal for carrying out the data exchange with the terminal device 10 (connection ready). Here, a message
30 indicating the start of the ticket checking processing is outputted to the display unit 6b (which displays "processing" or an indicator for a prescribed time).

Next, the terminal device 10 receives the connection signal from the ticket gate device 1 (step S403), and a
35 step for establishing the communication connection between

the ticket gate device 1 and the terminal device 10 is carried out (step S406). When this communication connection with the terminal device 10 is established, the radio communication unit 5 of the ticket gate device 1 receives
5 the data from the terminal device 10.

On the other hand, when the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the communication connection is not established between the
10 ticket gate device 1 and the terminal device 10 (steps S404 and S405).

More specifically, if the time-up function (not shown) in the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed
15 waiting period, the connection with the ticket gate device 1 is automatically interrupted. On the other hand, when the terminal device 10 received the connection signal within the prescribed waiting period, the connection is established.

20 Then, when the connection is established, a step for judging the validity of the data from the terminal device 10 is carried out at the judgement unit 7b (step S407). More specifically, after the communication connection is established between the ticket gate device 1 and the
25 terminal device 10, the radio communication unit 5 of the ticket gate device 1 receives the data from the terminal device 10, and outputs that data to the judgement unit 7b.

Then, when the passenger 30 in the ticket gate device 1 tries to pass despite of the fact that the processing of
30 the data carried out by the judgement unit 7b is unfinished, a step for closing the gate is carried out at the gate unit 3 (steps S408 and S409). More specifically, when the judgement unit 7b is in the state of processing the data, the passing refusal command signal for blocking
35 the passing of the passenger 30 in the ticket gate device 1

is outputted to the gate unit 3.

Then, when the passing refusal command signal is received, the gate unit 3 closes the gate so as to block the passing passenger 30 if the passenger 30 in the ticket gate device 1 passes the human sensor 4c. Also, the judgement unit 7b outputs the passing refusal command signal to the display unit 6b as well. Then, when the passing refusal command signal is received, the display unit 6b displays a warning message for warning the passenger 30 in the ticket gate device 1 (such as "do not pass the gate because the data is unprocessed", for example).

Also, when the data is valid, a step for opening the gate in the ticket gate device 1 is carried out (steps S410 and S411). More specifically, when it is judged that the data is valid, the judgement unit 7b outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the display unit 6b. Then, when the passing signal is received from the judgement unit 7b, the gate unit 3 opens the gate.

On the other hand, when it is judged that the data is invalid as a result of judging the validity of the data at the judgement unit 7b, a step for carrying out the invalidation processing is carried out (step S413). This step S413 for carrying out the invalidation processing is similar to the invalidation processing shown in Fig. 5.

Finally, a step for disconnecting the connection between the terminal device 10 and the ticket gate device 1 is carried out (step S412). More specifically, the detection unit 7a judges whether all of the human sensor 4a to 4c in the ticket gate device 1 are ON or not. When the detection signal indicating that all of the human sensors 4a to 4c are OFF is received, the detection unit 7a judges that the passenger 30 has passed the ticket gate device 1, and outputs a disconnection signal for disconnecting the

communication connection with the terminal device 10 to the radio communication unit 5. Then, when the disconnection signal is entered from the detection unit 7a, the radio communication unit 5 disconnects the communication connection with the terminal device 10.

In this way, when the judgement unit 7b is not processed the data yet, it is possible to block the passing passenger 30 in the ticket gate device 1.

(Effects of the gate entry system of this embodiment)

10 According to the gate entry system of this embodiment as described above, the data communication connection can be established between the terminal device 10 carried by the passenger and the ticket gate device 1 (the automatic checking and collecting machine, for example) in cooperation with the human sensor 4a, so that the automatic checking and collecting machine can have the communication connection with only the necessary correspondent.

Also, a plurality of human sensors 4a to 4c are provided at the ticket gate device 1 so that it is possible to comprehend the state of the passengers in the ticket gate device 1 easily. Also, when the communication connection cannot be established with the Bluetooth of the passenger despite of the fact that the communication connection is requested from the automatic checking and collecting machine (as in the case where the passenger quits to pass the ticket gate device 1 and goes out of the ticket gate device 1, for example), the human sensors 4a to 4c can sense that state and interrupt the communication connection (time-up function).

30 Also, the data transmitted from the terminal device 10 carried by the passenger can be replaced by the information regarding the passing permission for regulating the passage of the passenger (such as the ticket for the railway, the ticket for the movie, etc., for example), so that there is no need for the passenger passing the ticket gate device 1

to purchase the ticket at a specific place.

Also, the detectable range A2 of the human sensor 4a provided at a front side along the passing direction of the passageway does not belong to the communication possible
5 range A1 of the radio communication unit 5, so that it is possible to detect the subsequent passenger located outside the communication possible range of the radio communication unit 5 by the human sensor 4a located near the entrance.

Also, when the passenger tries to pass the gate unit 3
10 (by moving rapidly through the gate, for example) before the data transmission/reception carried out between the terminal device 10 carried by the passenger and the radio communication unit 5 is completed, it is possible to close the gate by a command from the control unit 7 so that it is
15 possible to prevent the passage of the passenger who has not been subjected to the proper data processing.

Also, when the connection between the terminal device 10 of the passenger and the radio communication unit 5 is already established, it is possible to display a message
20 for permitting an entry of more passengers besides the passenger already in the communication possible range A1 of the radio communication unit 5 (such as "subsequent entry permitted", for example).

On the other hand, when the connection between the
25 terminal device 10 of the passenger already in the communication possible range A1 of the radio communication unit 5 and the radio communication unit 5 is not established yet, it is possible to display a message for blocking the entry of the passenger following the passenger
30 already in the communication possible range A1 of the radio communication unit 5 (such as "subsequent entry not permitted", for example). In this way, even when more than one passengers have entered into the communication possible range A1 of the radio communication unit 5, it is possible
35 to eliminate the entry of the subsequent passenger so that

it is possible to prevent a data processing trouble that can be occurred between a preceding passenger and a subsequent passenger.

Also, the state of progress of the processing of the data transmitted to the radio communication unit 5 by the passenger can be displayed at the display unit 6a (6b), the passenger can easily comprehend the state of progress of the processing of the own data.

Also, the passenger can enter into the ticket gate device 1 according to the guidance of the display unit 6a (6b) provided along the passing direction. Also, the subsequent passenger can easily comprehend the state of waiting period until the processing of the preceding passenger is finished, so that it is possible to prevent the data processing trouble that can be occurred between a preceding passenger and a subsequent passenger.

(First modified embodiment)

Fig. 8A shows the perspective view of the ticket gate device 1 according to the first modified embodiment. As shown in Fig. 8A, it is possible to provide the gate unit 3a near the entrance, in addition to the gate unit 3b near the exit. More specifically, when the first passenger 30 enters the ticket gate device 1, the gate unit 3a near the entrance is closed so as to block the entry of the subsequent passenger 30. Then, when the processing of the first passenger 30 in the ticket gate device 1 is finished and the first passenger 30 passes the ticket gate device 1, the gate unit 3a near the entrance is opened so as to permit the entry of the subsequent passenger 30.

According to the ticket gate device 1 of this first modified embodiment, it is possible to block the subsequent passenger 30 more definitely compared with the case of having only one gate unit 3.

(Second modified embodiment)

Fig. 8B shows the perspective view of the ticket gate

device 1 according to the second modified embodiment. As shown in Fig. 8B, it is possible to provide a speech unit 8 to the ticket gate device 1.

5 The speech unit 8 of this modified embodiment calls for the attention by the speech to the terminal device 10 carried by the passenger 30, and can be provided in a form of a loudspeaker for generating sounds, for example. Note that the speech unit 8 can be provided near the entrance of the ticket gate device 1.

10 The operation of the ticket gate device 1 in this configuration can be as follows. First, the user sets an own ID code (such as name, number, symbol, etc.) by using the operation unit 11 of the terminal device 10. Then, when the data containing the own ID code is transmitted from the
15 terminal device 10 to the ticket gate device 1, the radio communication unit 5 receives that data.

Then, the data received by the radio communication unit 5 of the ticket gate device 1 is temporarily stored in the judgement unit 7b of the control unit 7, and when the
20 user of the terminal device 10 has not been processed properly (the user has tried to get out from the ticket gate device 1 despite of the fact that the user is still unprocessed, or more than two users have entered into the ticket gate device 1, for example), a warning signal
25 containing the ID code is outputted from the judgement unit 7b to the speech unit 8 so as to call for the attention of the user (such as "Mr. so and so please get out of the ticket gate device 1" or "please get out of the ticket gate device 1" in the case where the ID code has not been
30 entered into the judgement unit 7b, for example).

According to the ticket gate device 1 of this modified embodiment, it is possible to warn the passenger 30 directly by the speech from the speech unit 8, so that it is possible to call for the attention of the user quickly.

35 (Third modified embodiment)

Fig. 8C shows the perspective view of the ticket gate device 1 according to the third modified embodiment. As shown in Fig. 8C, the ticket gate device 1 may be provided with a shielding 9.

5 The shielding 9 of this modified embodiment shields the external noises, and can be provided in a form of a grounded conductor plate, for example. When the external noises are entered, this shielding 9 can shield the external noises by letting them go through the grounding of
10 the conductor plate.

In this way, even when the data is transmitted to one ticket gate device 1 among a plurality of ticket gate devices, the similar data for the other ticket gate device 1 will not be mixed so that the data transmitted by the
15 passenger 30 can be processed properly at the ticket gate device 1.

(Fourth modified embodiment)

Fig. 8D shows the ticket gate device 1 of the fourth modified embodiment, which has display unit 6c arranged
20 along the passing direction of the passenger 30 in the passageway, for guiding the passing by the passenger 30 according to the state of progress of the processing.

The display unit 6c shown in Fig. 8D is arranged along the passing direction of the passenger 30 in the
25 passageway, for guiding the passing of the passenger 30 according to the state of progress of the processing, and can be provided in forms of LEDs, for example. More specifically, when a state signal indicating that the data processing is still in progress is entered from the
30 judgement unit 7b, the display unit 6c flashes a half of the LEDs, for example.

Also, when a state signal indicating that the data processing is completed is entered from the judgement unit 7b, the display unit 6c flashes all the LEDs. In this way,
35 the passenger 30 passing the ticket gate device 1 can

objectively comprehend when it is possible to pass.

The operation of the ticket gate device 1 according to this modified embodiment can be as follows.

First, a step for turning the human sensor 4a ON is
5 carried out. More specifically, when the passenger 30 passes the human sensor 4a near the entrance of the ticket gate device 1, the human sensor 4a is turned ON. Then, when the human sensor 4a is turned ON, the detection signal indicating that the human sensor 4a is turned ON is
10 outputted to the detection unit 7a of the control unit 7.

Then, a step for setting the radio communication unit 5 of the ticket gate device 1 in the connection ready state is carried out. More specifically, when the detection signal indicating that the human sensor 4a is turned ON is
15 entered, the detection unit 7a outputs the reception signal for receiving the data from the terminal device 10 to the radio communication unit 5. Then, when the reception signal is received from the detection unit 7a, the radio communication unit 5 transmits a connection signal for
20 carrying out the data exchange to the terminal device 10.

Next, the terminal device 10 receives the connection signal from the ticket gate device 1, and a step for establishing the communication connection between the ticket gate device 1 and the terminal device 10 is carried
25 out. On the other hand, when the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the communication connection is not established between the ticket gate device 1 and the terminal device 10 (steps S104
30 and S105).

More specifically, if the time-up function (not shown) in the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the connection with the ticket gate device
35 1 is automatically interrupted. On the other hand, when the

terminal device 10 received the connection signal within the prescribed waiting period, the connection is established.

Next, a step for judging whether the data is valid or not is carried out. More specifically, after the communication connection is established between the ticket gate device 1 and the terminal device 10, the radio communication unit 5 of the ticket gate device 1 receives the data from the terminal device 10, and outputs that data to the judgement unit 7b in the control unit 7. When that data is received, the judgement unit 7b judges the validity of the data, such as the date of the ticket, the names of the stations to get on and off, the valid period of the ticket, etc.

Next, a step for displaying the state of progress of the data processing at the display unit 6c is carried out. The display unit 6c flashes a half of the LEDs, for example, when the state signal indicating that the data processing is still in progress from the judgement unit 7b.

Also, when the state signal indicating that the data processing is completed is received from the judgement unit 7b, the display unit 6c flashes all the LEDs.

Next, a step for displaying "valid" at the display unit 6b is carried out. More specifically, when it is judged that the data is valid as a result of judging the validity of the data at the judgement unit 7b, the judgement unit 7b outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the display unit 6b. Then, when the passing signal is entered from the judgement unit 7b, the display unit 6b displays a message indicating the validness such as "valid", for example.

Also, when the processing of the data is still in progress, the judgement unit 7b outputs the processing in progress signal indicating that the processing is still in progress to the display unit 6a (6b). Then, when the

processing in progress signal is received from the judgement unit 7b, the display unit 6a (6b) displays a message for refusing the entry of the subsequent passenger 30 (such as "no further entry permitted", for example).

5 Also, the display unit 6b displays a message indicating that the processing is still in progress (such as "processing", for example).

On the other hand, when it is judged that the data is invalid as a result of judging the validity of the data at
10 the judgement unit 7b, a step for carrying out the invalidation processing is carried out. This invalidation processing is carried out as shown in Fig. 5.

Finally, a step for disconnecting the connection between the terminal device 10 and the ticket gate device 1
15 is carried out. More specifically, the detection unit 7a judges whether all of the human sensor 4a to 4c in the ticket gate device 1 are ON or not. When all of the human sensors 4a to 4c are OFF, the detection unit 7a judges that the passenger 30 has passed the ticket gate device 1, and
20 outputs a disconnection signal for disconnecting the communication connection with the terminal device 10 to the radio communication unit 5. Then, when the disconnection signal is received from the detection unit 7a, the radio communication unit 5 disconnects the communication
25 connection with the terminal device 10.

(Fifth modified embodiment)

Fig. 9 shows the internal configuration of the ticket gate device 1 of the fifth modified embodiment. As shown in Fig. 9, it is possible to provide a passing judgement unit
30 7c in the control unit 7.

The passing judgement unit 7c of this modified embodiment judges whether the properly data processed passenger 30 passes or not. More specifically, the passing judgement unit 7b temporarily stores the data received by
35 the radio communication unit 5 first (including the ID

code, which will be referred to as the first ID data), and when the passenger 30 passes the ticket gate device 1, the data (including the ID code, which will be referred to as the second ID data) is received by the radio communication unit 5 of the ticket gate device 1 again and the second ID data is also temporarily stored in the passing judgement unit 7b.

Then, the passing judgement unit 7c compares the internally stored first ID data and second ID data, and if they coincide, the passing judgement unit 7c outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the gate unit 3. Similarly, if the first ID data and the second ID data do not coincide, the passing judgement unit 7c outputs the passing refusal signal for not passing the passenger 30 in the ticket gate device 1 to the gate unit 3.

In this way, even when the data of the subsequent passenger is erroneously received at the radio communication unit 5 and processed before the data of the preceding passenger 30, it is possible to limit the passage of the preceding passenger 30 for which the data processing has not been carried out.

The operation of the ticket gate device 1 according to this modified embodiment can be as follows. Fig. 10 shows the processing procedure of the ticket gate device 1 in this modified embodiment.

As shown in Fig. 10, a step for turning the human sensor 4a ON as the passenger 30 enters into the ticket gate device 1 is carried out first (step S501), and then a step for making the radio communication unit 5 in the ticket gate device 1 in the connection ready state is carried out (step S502). More specifically, when the passenger 30 passes the human sensor 4a near the entrance of the ticket gate device 1, the human sensor 4a is turned ON. Then, when the human sensor 4a is turned ON, the

detection signal indicating turning ON of that human sensor is outputted to the detection unit 7a of the control unit 7.

Then, when the detection signal indicating that the human sensor 4a is turned ON entered, the detection unit 7a outputs the reception signal for receiving the data from the terminal device 10 to the radio communication unit 5. Then, when the reception signal is transmitted from the detection unit 7a, the radio communication unit 5 transmits a connection signal for carrying out the data exchange with the terminal device 10 (connection ready). Here, a message indicating the start of the ticket checking processing is outputted to the display unit 6b (which displays "processing" or an indicator for a prescribed time).

Next, the terminal device 10 receives the connection signal from the ticket gate device 1 (step S503), and a step for establishing the communication connection between the ticket gate device 1 and the terminal device 10 is carried out (step S507). When this communication connection with the terminal device 10 is established, the radio communication unit 5 of the ticket gate device 1 receives the data from the terminal device 10. In this case, the received data includes the ID code for identifying the passenger 30 of the terminal device 10.

On the other hand, when the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the communication connection is not established between the ticket gate device 1 and the terminal device 10 (steps S505 and S506).

More specifically, if the time-up function (not shown) in the terminal device 10 does not receive the connection signal from the ticket gate device 1 within a prescribed waiting period, the connection with the ticket gate device 1 is automatically interrupted. On the other hand, when the

terminal device 10 received the connection signal within the prescribed waiting period, the connection is established.

Next, the validity of the data from the terminal
5 device 10 is judged at the judgement unit 7b, and if the content of that data is valid, a step for passing the passenger 30 in the ticket gate device 1 is carried out (step 509). More specifically, the radio communication unit
5 receives the data of the passenger 30 in the ticket gate
10 device 1 and outputs the ID code in that data to the passing judgement unit 7c.

Then, the passing judgement unit 7b temporarily stores the data received by the radio communication unit 5 first (the first ID data). Also, when the passenger 30 passes the
15 ticket gate device 1, the data (the second ID data) is received by the radio communication unit 5 of the ticket gate device 1 again and the second ID data is also temporarily stored in the passing judgement unit 7b.

Then, the passing judgement unit 7c compares the
20 internally stored first ID data and second ID data, and if they coincide, the passing judgement unit 7c outputs the passing signal for passing the passenger 30 in the ticket gate device 1 to the gate unit 3. Similarly, if the first ID data and the second ID data do not coincide, the passing
25 judgement unit 7c outputs the passing refusal signal for not passing the passenger 30 in the ticket gate device 1 to the gate unit 3 and the display unit 6b.

Then, when the ID data of the passenger 30 in the ticket gate device 1 do not coincide, the judgement unit 7b
30 carries out a step for closing the gate of the ticket gate device 1 (step S510), and then carries out a step for displaying "do not enter" at the display unit 6a and "passing disapproved" at the display unit 6b (step S511).

More specifically, when the passing refusal signal is
35 transmitted from the judgement unit 7b, the display unit 6a

displays a message for not passing the subsequent passenger (such as "do not enter", for example), and the display unit 6b displays a message for not passing the passenger 30 in the ticket gate device 1 (such as "passing disapproved",
5 for example).

Also, when the passenger 30 who has the second ID data passes the ticket gate 1, a step for opening the gate of the ticket gate device 1 is carried out (step S512). More specifically, when the second ID data is received at the
10 radio communication unit 5, that second ID data is outputted to the passing judgement unit 7c. Then, when the second ID data is received, the passing judgement unit 7c judges that the it coincides with the first ID data received first, and outputs the passing signal for passing
15 the passenger 30 in the ticket gate device 1 to the gate unit 3.

Also, the passing judgement unit 7c outputs a release command for releasing the warning display displayed at the display unit 6b to the display unit 6b. Then, when the
20 passing command signal is received, the gate unit 3 opens the gate of the ticket gate device 1 (step S513). Also, when the release command is entered, the display unit 6b releases the warning display in order to pass the passenger 30 in the ticket gate device 1. On the other hand, when the
25 passenger who has the first ID data does not pass the ticket gate device 1, a step for maintaining the warning display (such as "passing disapproved", for example) is carried out (step S511).

Finally, a step for disconnecting the connection
30 between the terminal device 10 and the ticket gate device 1 is carried out (step S514). More specifically, the detection unit 7a judges whether all of the human sensor 4a to 4c in the ticket gate device 1 are ON or not. When the detection signal indicating that all of the human sensors
35 4a to 4c are OFF is received, the detection unit 7a judges

that the passenger 30 has passed the ticket gate device 1,
and outputs a disconnection signal for disconnecting the
communication connection with the terminal device 10 to the
radio communication unit 5. Then, when the disconnection
5 signal is transmitted from the detection unit 7a, the radio
communication unit 5 disconnects the communication
connection with the terminal device 10.

As described, according to the present invention, it
is possible to carry out the processing of the passengers
10 properly at the automatic checking and collecting machine
side, even when the radio technology (especially the
Bluetooth) is applied to the automatic checking and
collecting machine, for example.

It is also to be noted that, besides those already
15 mentioned above, many modifications and variations of the
above embodiments may be made without departing from the
novel and advantageous features of the present invention.
Accordingly, all such modifications and variations are
intended to be included within the scope of the appended
20 claims.

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